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## EUPATORIUM PURPUREUM AND ITS ALLIES.

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THE verticillate-leaved Eupatoriums have long given trouble to American botanists. In connection with work on the flora of Central New York, the writer has found it necessary to make some disposition of the material ordinarily recognized as *Eupatorium purpureum*. That more than one form is to be found under this name in New York State has been apparent for some time, but the limits and characters of these forms did not seem to agree with those recognized by various authors as delimiting the numerous subdivisions of this species. The problem was taken, with others, to the Gray Herbarium, where Dr. Robinson kindly placed at the writer's disposal the very complete collection of *E. purpureum* in that institution, and also photographs made by him of Linnean and Willdenovian specimens in European herbaria. This material was supplemented by the rich collection of New England Eupatoriums in the herbarium of the New England Botanical Club, and of New York State plants of this group in the herbarium of the New York State College of Agriculture. As a result of this study, a treatment has been worked out which it is hoped will aid in clearing up the difficulties that have so long surrounded this section of Eupatorium.

Briefly stated, four species have been confused under the general name *E. purpureum* L. For clearness, these may be numbered, and their most striking characters listed, as follows:

1. Florets 6-9, rarely 5-12: stem speckled: leaves usually in 3's or 4's, ovate, abruptly contracted at the base, more or less plainly

- 3-nerved. Along the Coastal Plain from eastern Massachusetts and southern New Hampshire to South Carolina. A plant of wet soil.
2. Florets 9-15, rarely 8-20: stem speckled: leaves in 4's or 5's, rarely in 3's or 6's, gradually tapering at the base, and pinnately-veined. Newfoundland through northern New England to western Connecticut and central Pennsylvania, westward to Illinois, and Colorado, New Mexico and British Columbia. A plant of wet soil.
  3. Florets 6-7, rarely 5 or 8: stem rarely speckled, evenly purple, glaucous, hollow: leaves in 4's-6's, rather bluntly and finely toothed: corolla less than 5 mm. long. Southern Maine and Rhode Island to Florida, Texas, and Oklahoma; also in western Pennsylvania and Ohio. A plant of damp woods and pastures, on the Atlantic Coast and Uplands.
  4. Florets 5-6, rarely 3-7: stem rarely speckled, purple only at the nodes, scarcely glaucous, solid: leaves in 3's or 4's, rarely in 2's or 5's, sharply toothed: corolla 5-7 mm. long: heads paler than in the other species. Eastern Massachusetts and southern New Hampshire westward to Wisconsin, and southward to Pennsylvania, Kentucky, Oklahoma and Nebraska; also in the mountains from Virginia to Georgia. A plant of rich upland woods, rarely found near the coast.

The selection of names for these species has been found difficult. In the following discussion of the Linnean types the principle is observed that if there exists a specimen which Linnaeus had in hand when the description was written, this is to be considered the type, and is to be given the greatest weight in deciding upon the application of the name. If no such specimen exists, or if specimens and characters of two or more species are confused in the description, thus rendering definition by this means impossible, then the cited synonymy is to be employed in determining the type so far as it is of value.

In the first edition of the *Species Plantarum* (p. 838. 1753), Linnaeus gave the name *E. purpureum* to an American species of *Eupatorium* with verticillate leaves, and at the same time noted a var.  $\beta$ . In the *Amoenitates Academicae*, *E. maculatum* was described by Linnaeus; and in the second edition of the *Species Plantarum* both species were treated at length. The citations under  $\beta$  in the

first edition all refer to our No. 1 above. Hermann's plate, and also that of Morrison, are plainly this plant; so also is the Hortus Cliffortianus plant in the British Museum as shown by a photograph. Moreover, the description accompanying the Ray citation represents this species, as shown by the number of leaves cited, as well as by a reference to the spotted stem and leaves like a nettle. Also, the original portion of the description of *E. purpureum* was drawn, either from the  $\beta$  references, or from the Hortus Cliffortianus plant, or both, and therefore refers to No. 1: "folia \* \* \* lato-lanceolata \* \* \* lanceolato-ovata \* \* \* petiolata \* \* \* Calyces florum incarnati. Flosculi octo."

In the *Amoenitates*, where *E. maculatum* was first proposed, all the citations under the original  $\beta$  are transferred to that species, and they are the only citations given. However, Linnaeus's description of *E. maculatum* applies much better to our No. 2: "foliis quinque tomentosis lanceolatis. \* \* \* Folia quinque vel sex," since this northern plant usually has more lanceolate leaves, which are commonly more hairy underneath, and more frequently borne in 5's or 6's than is the case in plant No. 1. Plant No. 1 never has the leaves in 6's, and very rarely, if ever, in 5's. The situation is still further complicated by Linnaeus in the closing statement of the description where he says that *E. maculatum* is his variety of *E. purpureum* as to both synonymy and description. In the Linnean herbarium is a specimen from Kalm which Linnaeus must have had at the time the *Species Plantarum* was written, and which is undoubtedly plant No. 2. Moreover, plant No. 2, rather than No. 1, is much more likely to have been found by Kalm in the regions visited by him; since No. 1 is coastal, and not northern. A photograph of the specimen shows six leaves in the whorls (though unusual even for this species), and in every way answers the description of *E. maculatum* given by Linnaeus. There is every reason to suppose, therefore, that Linnaeus had this in hand when the description was drawn, and it is therefore to be considered the type-specimen. The name *E. maculatum* must, therefore, be applied to our No. 2, notwithstanding the fact that the synonymy applies to No. 1.

It remains to determine the application of the name *E. purpureum*. The statement has already been made that the original description seems to have been drawn from the  $\beta$  portion of the species. In the second edition of the *Species Plantarum*, where he first defines

together both *E. purpureum* and *E. maculatum*, Linnaeus recasts the description of *E. purpureum*, omitting the statement that the stem was spotted, and stating that it was, "viridis, ad exortum petiolarum purpurascens." This new description excludes both spotted-stemmed species, and narrows the application of the name to species Nos. 3 and 4. However, a still further study of the description shows that Linnaeus was confusing both of these, since the statement quoted above applies best to No. 4; while the statement "folio quina lanceolata-ovata. Calyces florum incarnati. Flosculi octo" applies to No. 3. A photograph of material now in the Linnaean herbarium seems to show, though an accurate identification of it is impossible, that Linnaeus at some time had specimens of both species. It is necessary, therefore, because of this confusion, to ignore the Linnaean description, and to attempt the definition of the name through the synonymy. The writer has not had access to the Colden citation. The plant on which the Gronovian reference was based was most probably our No. 3, as judged by the statement of Gronovius: "foliis ovato-lanceolatis obtuse serratis \* \* \* foliis longis," and Gronovius's reference to Cornut which will later be shown to be No. 3. Moreover, though not much material has been seen from Virginia, it seems likely that No. 4 is largely confined to the mountains in that state, while No. 3 extends to the coast, and would be more likely to have been found by Clayton.

The next citation of Linnaeus was to Cornut where a plate and extended discussion is given. The plate is not convincing, as it might represent either species. In the text, however, is the statement: "Caules \* \* \* rubescentes (cinereo tamen colore suffusi) [i. e., glaucous] \* \* \* inanes intus," which can refer only to No. 3. The source of Cornut's plant, however, is in doubt, as our No. 3 is not known from Canada where the title of his work would lead one to infer that it was obtained.

The other citation of Linnaeus was to Morrison, but the figure there given seems to have been copied from Cornut, and the description is a verbatim transcription of Cornut's. The citations of Linnaeus, therefore, so far as they can be identified, unanimously refer to plant No. 3. Moreover, the key heading, "\*Calycibus octofloris," under which *E. purpureum* is found in the Species Plantarum, is appropriate to this plant and not to No. 4, which has from 3 to 6 florets. The name *E. purpureum* must therefore be used for our species No. 3.

In the *Species Plantarum*, on the page preceding that on which *E. purpureum* was described, Linnaeus proposed another species under the name *E. trifoliatum*. The original description consists solely of the statement "foliis ternis," which plainly is insufficient to define the species; and it is therefore necessary to depend upon the citations given, which are to Gronovius and Ray. The description given by Gronovius is inconclusive, having been drawn apparently from a slender shade plant with whitish heads without stating such characters as are of value here. The Clayton plant cited by Gronovius is his No. 620. A photograph of a specimen now in the British Museum labelled Clayton No. 620 shows it to be probably our No. 3. The leaves are lanceolate, bluntly and finely toothed; and, so far as can be made out from the print, the stem is purple and glaucous and not darker at the nodes. The stem is also cracked in one place in a manner more likely to occur if it were hollow. Also, as has already been stated, No. 3 is more likely to have been found by Clayton than No. 4. However, no species normally has leaves of this form in 3's. The specimen seems abnormal, but is more reasonably placed in No. 3. *E. trifoliatum* L. and *E. purpureum* L. are therefore to be considered one and the same species. Most of the early writers retained *E. trifoliatum* in addition to the various names employed by them for the other species. So far as the writer is aware, Torrey and Gray (*Fl. N. A.* ii. p. 82, 1841) were the first to unite *E. trifoliatum* and *E. purpureum*. This was done under the latter name; which, therefore, is the one to be retained under the Vienna Code (Chapter III, Sect. 5, Art. 46) which says: "When two or more groups of the same nature are united, the name of the oldest is retained. If the names are of the same date, the author chooses, and his choice cannot be modified by subsequent authors."

The oldest name that may be legitimately applied to our species No. 1 is the *E. verticillatum* of Lamarck (*Encyc.* ii, 405, 1786). This was divided by the author into two parts,  $\alpha$  and  $\beta$ . Lamarck's citations and descriptions do not entirely agree. The Cornut and Morrison citations under  $\alpha$  are the ones listed by Linnaeus under *E. purpureum*  $\alpha$ , and have been shown above to refer to our No. 3. The Hermann reference under  $\beta$ , as has already been pointed out, refers to No. 1. However, the description given by Lamarck shows that both  $\alpha$  and  $\beta$  are to be referred to species No. 1. In this description reference is made to a dull-green dotted stem and purple

heads with six or seven florets, a combination of characters appropriate to no other species than No. 1; and under  $\beta$  the statement that the stem is obscurely purple and spotted, leaves parallel-ribbed and not cottony, flowers about 8, must also refer to No. 1. It is true the statement under  $\beta$  of leaves in 5's is not appropriate to No. 1, which very rarely has 5 leaves in the whorl, and yet it could not refer to No. 2, for the number of florets is stated as only 8. Lamarck's description was drawn from a garden plant, and No. 1 might possibly have produced 5 leaves under cultivation. If greatest weight in determining the application of Lamarck's name is given to his description, then the name *E. verticillatum* must be applied to our species No. 1.

The oldest available name for the fourth species is apparently Michaux's *E. falcatum*. In his description the statement leaves 4-verticillate, oval-lanceolate, acuminate at each end and subfalcate, calyx 5-flowered, is most appropriate to No. 4. The panicle is stated as multicorymbose, and the flowers white. This species often has a very large panicle, and pale heads which are frequently nearly white in dense shade.

The following is a key to the species and varieties discussed:

- a. Leaves ovate to ovate-lanceolate, abruptly contracted into the petiole, more or less 3-nerved: plant somewhat viscid, scabrous-puberulent, with a strong odor when fresh: stem finely purple-speckled, not glaucous: inflorescence convex (leaves in 3's or 4's, very rarely in 2's or 5's: florets 6-9, rarely 5-12).....1. *E. verticillatum*.
- a. Leaves lanceolate to oval, tapering at the base, pinnately veined (except sometimes in the variety of No. 2): plant not viscid and not odorous. b
- b. Florets 9-15 (rarely 8-20): inflorescence or its divisions flat-topped: stem speckled if not obscured by too deep purple, not glaucous (leaves puberulent to glabrate beneath, in 4's or 5's, rarely in 3's or 6's: florets scarcely exserted). c.
- c. Leaves below the inflorescence, and bracts, inconspicuous. 2. *E. maculatum*.
- c. Leaves surrounding the inflorescence, and bracts, large and conspicuous, much exceeding the inflorescence, often more or less 3-nerved. var. *foliosum*.
- b. Florets 5-7 (rarely 3-8): inflorescence convex: stems rarely speckled, more or less glaucous. d.
- d. Stems fistulose, purple, plainly glaucous: leaves in 4's to 6's, bluntly toothed, scabrous-puberulent beneath or glabrate: florets scarcely exserted: corolla 3.5-4.8 mm. long, very rarely longer. 3. *E. purpureum*.
- d. Stems solid, green with purple nodes, faintly glaucous: leaves in 3's or 4's, very rarely in 2's or 5's, sharply toothed, villous-pubescent beneath or glabrate: florets much exserted: corollas 5.5-7.5 mm. long: heads paler than in the other species.....4. *E. falcatum*.

1. *E. VERTICILLATUM* Lamarck, Encyc. ii. 405 (1786)  $\alpha$  and  $\beta$ . *E. purpureum* L. Sp. Pl. Ed. 1, ii. 838 (1753) as to synonymy under  $\beta$ , and as to description, but not as to synonymy under  $\alpha$ , and not as

to his later treatment. *E. maculatum* L. Amoen. Acad. iv. 288 (1759) as to synonymy only. *E. fusco-rubrum* Walter, Fl. Car. 199 (1788) probably. *E. punctatum* Willd. Enum. Pl. Berol. 853 (1809) (photo. seen). *E. dubium* Willd. in Lam. Encyc. Sup. 2. 606 (1811). *E. ternifolium* Elliott, Bot. So. Car. and Ga. ii. 306 (1824) probably. *E. purpureum* var. *maculatum* Darlington, Fl. Cestrica 453 (1837).—Stem finely speckled with purple, green or more often suffused with purple, not glaucous, scarcely darker at the nodes, usually solid but frequently hollow, scabrous-puberulent above and apparently somewhat glandular: leaves generally in 3's or 4's occasionally in 2's or 5's, from broadly to narrowly ovate, sub-acuminate, abruptly narrowed to a conspicuous petiole which is 10–15 mm. long, coarsely serrate with somewhat rounded and mucronate or sharper teeth, veiny and often rugose, more or less plainly 3-nerved, above usually scabrous, beneath atomiferous and glabrous except on the veins which are more or less scabrous-puberulent: inflorescence rather small and dense, convex, when well developed hemispherical or short-oblong: heads narrowly oblong, 6–9 (rarely 5 or 12)-flowered, usually deep-purple: involucrel bracts slightly narrower than in the next species; the inner often sub-acute: corolla 4.5–5.5 mm. long, slightly exserted: achenes 3.5–4.5 mm. long.—Borders of swamps and in marshes, in sandy or gravelly acid soils: on the Coastal Plain from eastern Massachusetts and southern New Hampshire to South Carolina. NEW HAMPSHIRE: Rochester, 1888, Mrs. E. Bartow; Derry, 1916, C. F. Batchelder; Mason, 1916, C. F. Batchelder; Jaffrey, 1896, W. Deane, 1897, B. L. Robinson, no. 379; Rindge, 1916, C. F. Batchelder; Gilsum, 1899, M. L. Fernald, no. 209. MASSACHUSETTS: eastern Massachusetts, 1854, W. Boott; North Andover, 1885, C. H. Morss; Wakefield, 1886, F. S. Collins; Sherborn, 1911, Martha L. Loomis, no. 430; South Royalston, 1907, J. A. Bates; Maugus Hill, Wellesley, 1897, E. F. Williams; Brookline, 1900, G. E. Morris (white flowers); Blue Hills, 1894, W. H. Manning; Cohasset, 1901, E. F. Williams; Loon Pond, Lakeville, 1913, Fernald & Long, no. 10490; Mashpee, 1916, Knowlton, Bean & Bird; East Sandwich, 1919, Fernald & Long, no. 19163; Allen's Harbor Creek Harwich, 1919, Fernald & Long, no. 19166; Brewster, 1912, F. S. Collins, no. 1649; Chilmark, 1911, J. A. Cushman, no. 7571; New Bedford, 1872, G. Mackie. RHODE ISLAND: Rumford, 1903, E. F. Williams; Providence, 1844, G. Thurber; Crescent Beach, Block Island, 1913, Fernald, Long & Torrey, no. 10491. CONNECTICUT: Waterford, 1899, C. B. Graves; Saybrook Junction, 1914, R. W. Woodward (flowers white); Southington, 1898, L. Andrews, no. 42, 1898, C. H. Bissell, no. 311; Tranquillity Farm, Middlebury, 1896, W. M. Shepardson. NEW YORK: Port Chester, 1886, Louise M. Stabler. NEW JERSEY: May's Landing, 1916, I. Tidestrom, no. 8042; Hammonton, 1917, A. Gershoy, no. 660; Dividing Creek, 1910, B. Long, no. 4843; Atsion, 1917,

*A. Gershoy*, no. 661; Bennett, 1917, *A. Gershoy*, no. 659. DELAWARE: near Delaware City, 1916, *I. Tidestrom*, no. 7903. DISTRICT OF COLUMBIA: Washington and vicinity, 1898, *E. S. Steele*. SOUTH CAROLINA: Santee Canal, *Ravenel*.

This is the commonest species in low ground along the Coastal Plain. Albino forms are occasionally found. The glandular pubescence apparently gives the plant a characteristic strong odor not present in the other species, but this observation needs verification. The stem is occasionally hollow. The variation in number of florets among the specimens studied was as follows: 4 with 5 florets, 17 with 6 florets, 13 with 7 florets, 10 with 8 florets, 11 with 9 florets, 5 with 10 florets, 2 with 11 florets, and 1 with 12 florets. The number of leaves in the whorl fluctuated in the following proportion: 4 with 2 leaves (small plants), 27 with 3 leaves, 28 with 4 leaves, and 1 with 5 leaves.

2. *E. MACULATUM* L. Amoen. Acad. iv. 288 (1759) as to original description and specimen in the Linnaean Herbarium, but not as to citations. *E. Bruneri* A. Gray, Synopt. Fl. i. pt. 2, 96 (1884). *E. atromontanum* A. Nelson, Bot. Gaz. xxxi. 400 (1901). *E. Rydbergii* Britton, Manual 921 (1901). *E. purpureum* var. *Bruneri* Robinson, Proc. Amer. Acad. xlii. 44 (1906) for the more hairy western plants.—Stem green and finely purple-speckled, more often the spots obscured by a deep purple suffusion, not glaucous, puberulent above, not darker at the nodes, very exceptionally hollow: leaves most commonly in 4's or 5's, rarely in 3's or 6's, elliptic-ovate or elliptic-lanceolate, tapering at base and apex, short petioled or nearly sessile, sharply and often irregularly incurved-serrate varying to more finely crenate-serrate, pinnately veined, rugose, above glabrous or slightly scabrous, beneath atomiferous and from nearly glabrous to canescent with minute crisp scabrous hairs on the veins or more commonly on both veins and parenchyma: inflorescence or its parts flat-topped, dense: heads broadly oblong, 9–15 (rarely 8 or 20)-flowered, usually deep purple: bracts of the involucre broad, obtuse: corollas 5 mm. long, their tips usually but slightly or not at all exerted beyond the involucre: achenes 3.4–4.2 mm. long.—Open grounds and the borders of thickets, along streams and in wet sedgy meadows, in rich often mucky scarcely sandy soils, generally in calcareous regions: Newfoundland and Quebec to northern New England, western Massachusetts, western Connecticut, and Lancaster County, Pennsylvania; westward through Michigan, Illinois, Colorado, Utah, and Saskatchewan to New Mexico and British Columbia. NEWFOUNDLAND: Salmonier River, 1894, *Robinson & Schrenk*, no. 40. QUEBEC: Grindstone Island, Magdalen Islands, 1912, *Fernald, Long & St. John*, no. 8093; vicinity of Cap a L'Aigle, 1905, *John Macoun*, no.



68338. PRINCE EDWARD ISLAND: Hillsborough River, Mt. Stewart, 1912, *Fernald, Bartram, Long & St. John*, no. 8092; Brackley Point, 1912, *Fernald, Long & St. John*, no. 8094. MAINE: Lake Hadley, East Machias, 1898, *M. A. Barber*; Orono, 1887, *M. L. Fernald*, 1896, *E. D. Merrill*, no. 437; Dover, 1895, *M. L. Fernald*, no. 307; Abbott, 1916, *Fernald & Long*, no. 14647; Fairfield, 1916, *Fernald & Long*, no. 14646; Greenvale, 1894, *K. Furbish*; South Deer Isle, 1914, *A. F. Hill*, no. 1834; Cow Island, Topsham, 1910, *K. Furbish*; South Poland, 1895, *K. Furbish*; Wells, 1898, *K. Furbish*. NEW HAMPSHIRE: Shelburne, 1915, *W. Deane*; Dartmouth College Grant, 1914, *A. S. Pease*, no. 16194; Gate of Crawford's Notch, 1884, *C. E. Faxon* (albino form); Walpole, 1916, *C. F. Batchelder*. VERMONT: Willoughby, 1898, *G. G. Kennedy*; Ripton, 1908, *E. F. Williams*; Manchester, 1898, *M. A. Day*, no. 91. MASSACHUSETTS: Greenfield, 1913, *J. Murdoch, Jr.*, no. 5208; Worthington, 1912, *B. L. Robinson*, no. 596; Cheshire and vicinity, 1912, *E. J. Winslow*; Lenox, 1911, *R. Hoffmann* (shade form); Stockbridge, 1902, *R. Hoffmann*; New Marlboro, 1912, *R. Hoffmann*; Mount Washington, 1915, *F. G. Floyd*. NEW YORK: Canton, 1914, *Orra P. Phelps*; Ithaca, 1913, *E. L. Palmer*, nos. 1190 & 1191; 1915, *C. C. Thomas*, no. 5099; 1919, *A. J. Eames*, nos. 12973, 12975, 12978, 12979; 1919, *Eames & Wiegand*, no. 12974; 1919, *Wiegand*, no. 12976; 1919, *L. F. Randolph*, no. 12972; Big Gully Ravine, Springport, 1919, *Eames, Randolph & Wiegand*, no. 12980; North Spencer, 1915, *Eames & MacDaniels*, no. 5088; Spencer Lake, 1919, *Eames & Wiegand*, no. 12981. PENNSYLVANIA: Dillerville Swamp, in limestone, 1901, *A. A. Heller*. ONTARIO: Plevna, 1902, *J. Fowler*; Island Lake, Algonquin Park, 1900, *Macoun*, no. 21813. OHIO: Birmingham, 1914, *L. H. MacDaniels*, no. 151. MICHIGAN: Keweenaw County, 1890, *O. A. Farwell*, no. 777; Turin, 1901, *B. Barlow*; Flint, 1909, *E. E. Sherff*; South Haven, 1911, *O. E. Lansing, Jr.*, no. 3316. INDIANA: East Chicago, 1910, *O. E. Lansing, Jr.*, no. 2804. ILLINOIS: Ravinia, 1911, *E. E. Sherff*; Cedar Lake, Lake County, 1906, *Gleason & Shobe*, no. 142; South Chicago, 1913, *H. H. Smith*, no. 5752; near Wady Petra, 1900, *V. H. Chase*, no. 764. WISCONSIN: Fort Howard Marsh, Brown County, 1890, *J. H. Schuette*; Osceola, 1900, *C. F. Baker*. IOWA: Ames, 1896, *Pammel & Ball*, no. 34. MINNESOTA: Cass Lake, Cass County, 1914, *L. H. & H. E. Pammel*, no. 553; Muskoda, Red River Valley, 1901, *C. A. Ballard*, no. 3083. NORTH DAKOTA: near Bottineau, 1902, *J. Lunell*. SOUTH DAKOTA: Black Hills, 1910, *J. Murdoch, Jr.*, no. 4296. NEBRASKA: sand hills of central Nebraska, 1893, *P. A. Rydberg*, no. 1682; Fort Niobrara, Knox County, 1908, *J. M. Bates*, no. 4686; Paddock, 1893, *F. Clements*, no. 2797. COLORADO: Fort Collins, 1881, *Bruner* (type of *E. Bruneri* Gray). WYOMING: Beaver Creek, Black Hills, 1896, *A. Nelson*, no. 2553 (type number of *E. atromontanum* Nelson). UTAH: Wasatch Mountains, 1872,

*Wheeler*. NEW MEXICO: Fort Wingate, *Dr. Matthews*. SASKATCHEWAN: 1857-58, *E. Bourgeau*. BRITISH COLUMBIA: Fraser River, 1858, *Lyall*; Chilliwack Valley, 1901, *J. M. Macoun*, no. 26486.

Var. **foliosum** (Fernald) comb. nov. *E. purpureum* var. *foliosum* Fernald, RHODORA x. 86 (1908).—Leaves large, ovate-oval, with a tendency toward a 3-ribbed base, thin, nearly or quite glabrous: inflorescence small, surrounded and usually much surpassed by the large lance-ovate upper leaves and bracts.—Newfoundland and Saguenay County, Quebec to northern New England and possibly Lake Superior. NEWFOUNDLAND: Manuel's River, 1894, *Robinson & Schrenk*; Brigus Junction, 1911, *Fernald & Wiegand*, no. 6275; Grand Falls, 1911, *Fernald & Wiegand*, no. 6276; Bluff Head, Bay of Islands, 1898, *A. C. Waghorne*, no. 18; Harry's River, 1910, *Fernald & Wiegand*, no. 4133. QUEBEC: Dartmouth River, 1904, *Collins, Fernald & Pease*; Mingan, 1915, *H. St. John*, no. 90749. PRINCE EDWARD ISLAND: Bloomfield, 1912, *Fernald, Long & St. John*, no. 8095. NEW BRUNSWICK: Kent County, 1870, *J. Fowler*. MAINE: Van Buren, "the common form," 1900, *M. L. Fernald*; Hamlin, 1901, *Fernald*; Fort Fairfield, 1901, *E. F. Williams*; Boundary Lake, 1902, *Eggleston & Fernald*; Fairfield, 1916, *Fernald & Long*, no. 14648; Bridgton, 1912, *L. R. Martin*. NEW HAMPSHIRE: Ice Gulch, Randolph, 1908, *A. S. Pease*, no. 11498; Pittsburgh, *Fernald & Pease*, no. 17068; Jefferson, 1916, *Pease*, no. 16837. MICHIGAN: moist thickets, Keweenaw County, 1887, *O. A. Farwell*, no. 441 (doubtful).

*E. maculatum* is a northern plant of the richer, more calcareous soils, and is therefore nearly or quite absent from the sandy coastal plain from New England southward. In Central New York it is the characteristic joe-pye weed, occurring in great abundance everywhere in low grounds except perhaps in acid bogs. Locally it is somewhat variable as affected by shade and moisture, but geographically it is much more so. In the northeast the var. *foliosum* seems distinct enough to warrant separate treatment, but the other variations pass one into the other so gradually that no practical dividing lines can be drawn. Thus the leaves of the northeastern specimens are only slightly hairy beneath, but as one travels westward they gradually become more hairy until some plants on the Great Plains have the leaves distinctly whitened on the under surface. Locally, too, the degree of pubescence may fluctuate with the exposure. The more canescent western plants have been separated by Robinson as *E. purpureum* var. *Bruneri* (Gray) Robins. (l. c.). Several sheets of var. *foliosum* from Gaspé have the upper portion of the stem, and to a certain extent the under surface of the leaves, villous instead of

crisp-puberulent. Scattered specimens of the typical form have narrow leaves with fine crenate serrations resembling those of *E. purpureum*, a variation the significance of which is not understood but which is probably ecological. The florets vary considerably in number, due apparently in some cases at least to local conditions. Among the specimens examined the number of florets ran as follows: 1 with 7 florets, 2 with 8 florets, 10 with 9 florets, 12 with 10 florets, 12 with 11 florets, 30 with 12 florets, 17 with 13 florets, 10 with 14 florets, 7 with 15 florets, 1 with 16 florets, 3 with 17 florets, 1 with 18 florets, 1 with 19 florets, 0 with 20 florets, and 1 with 21 florets. The leaves in the whorls fluctuate within narrow limits. The number counted ran as follows: 1 with 2 leaves (starved specimen), 7 with 3 leaves, 55 with 4 leaves, 54 with 5 leaves, and 2 with 6 leaves.

3. *E. PURPUREUM* L. Sp. Pl. ed. 1, ii. 838 (1753) as to synonymy under  $\alpha$ , which in this case determines the type. *E. trifoliatum* L. Sp. Pl. ed. 1, ii. 837 (1753), placed under *E. purpureum* by T. & G. in 1841. *E. americanum* Hill, Brit. Herb. 453 (1756). ? *E. purpureum*  $\gamma$  *angustifolium* T. & G. Fl. N. Amer. ii. 82 (1841). *E. fistulosum* Barrett, Eupat. verticillate (1841), see also Wood's Class Book, ed. 2, 314 (1847).—Stems normally unspeckled, occasionally mottled, uniformly suffused with purple and not darker at the nodes, plainly glaucous, glabrous, hollow: leaves in 4's-6's, very rarely in 7's, elliptic-lanceolate, acuminate, tapering gradually to the nearly sessile base, regularly and finely crenate-serrate, scarcely rugose, above glabrous, beneath atomiferous and sparingly fine-puberulent on the veins only, or commonly almost glabrous; the veins numerous, spreading, regularly decreasing toward base and apex of the leaf; inflorescence crisp-pubescent, convex, often hemispherical, when well developed large and loose with the lower branches divaricate or horizontal: heads purple, narrowly cylindrical, 6-7 (rarely 5 or 8)-flowered: bracts of the involucre mostly obtuse: corolla 3.5-4.8 mm. long, slightly or not at all exserted: achenes 3.2-4.5 mm. long.—Low fields and the borders of thickets, if not too wet, in rich sandy and gravelly scarcely calcareous soils: southern Maine to Rhode Island, Florida, Texas and Oklahoma, and from eastern Kentucky, and West Virginia through western Pennsylvania to Ohio. MAINE: Cape Elizabeth, 1911, *M. L. Fernald*; Biddeford Pool, 1900, *G. G. Kennedy*. MASSACHUSETTS: Concord, *E. S. Hoar*; Milton, 1899, *G. G. Kennedy*; East Sandwich, 1919, *Fernald & Long*, no. 19168; Deerfield, 1908, *M. A. Day*, no. 62. RHODE ISLAND: Providence, *G. Thurber*. CONNECTICUT: Pomfret, 1910, *Sarah R. Armington*; Gully Brook, Hartford, 1907, *A. W. Driggs*; Ledyard, 1901, *C. B. Graves*, no. 234. MARYLAND: Ellicott City, 1916, *G.*

*Arsène*. DISTRICT OF COLUMBIA: 1901, *E. S. Steele*; Brookland, 1908, *T. Holm*; near Fort Totten, 1915, *T. Holm*. VIRGINIA: Rappahannock River, 1915, *I. Tidestrom*, no. 7607; Bedford County, 1871 & 1872, *A. H. Curtiss*. WEST VIRGINIA: Harman, 1904, *A. H. Moore*, no. 2167; Dry Fork River near Harman, 1904, *J. M. Greenman*, no. 236. KENTUCKY: near Poor Fork Post Office, 1893, *T. H. Kearney, Jr.*, no. 214. SOUTH CAROLINA: Santee Canal, *H. W. Ravenel*. ALABAMA: *Buckley*. FLORIDA: Eustis, 1895, *G. V. Nash*, no. 2118. TEXAS: Pope, *ex herb. G. Thurber*. OKLAHOMA: Page, 1914, *O. W. Blakley*, no. 3417. ARKANSAS: southwestern Arkansas, *F. L. Harvey*, no. 4. PENNSYLVANIA: Pittsburgh, 1831, *Holz*. OHIO: Little Mountain, 1897, *J. M. Greenman*, no. 310.

In general this plant is very constant in its characters. One specimen from Pittsburgh, Pa. (*Holz*) has corollas longer than 5 mm.; otherwise this character of the corolla is good. The variation in florets was: 6 with 5 florets, 14 with 6 florets, 5 with 7 florets, and 1 with 8 florets. The variation in number of leaves in the whorl was: 7 with 4 leaves, 5 with 5 leaves, 6 with 7 leaves, and 1 with 8 leaves.

4. *E. FALCATUM* Michx. Flor. Bor. Am. ii. 99 (1803). *E. purpureum* L. Sp. Pl. ed. 2, 1173 (1763) as to description in part, not as to synonymy. *E. amoenum* Pursh, Fl. Am. Sept. ii, 514 (1814). *E. purpureum* var. *amoenum* A. Gray, Synopt. Fl. N. A. i. pt. 2, 96 (1884). *E. purpureum* var. *falcatum* Britton, Mem. Torr. Bot. Club v. 312 (1894).—Stems normally unspotted, rarely mottled, green, purple at the nodes, rarely more purplish, scarcely glaucous, glabrous or nearly so, solid: leaves mostly in 4's, less commonly in 3's, rarely in 2's or 5's, lanceolate to ovate-oval or rarely ovate, acuminate, tapering gradually to the petioled or nearly sessile base or rarely more abruptly tapering, sharply serrate, slightly rugose; veins numerous, less spreading and less regular than in the last, decreasing gradually toward base and apex; blade glabrous and nearly smooth above, atomiferous and from glabrous to densely crisp-villous beneath, the hairs longer and softer than in the other species: inflorescence crisp-downy, convex, when well developed hemispherical or short-oblong and loose, often very large and open (up to 5 dm. long and 4 dm. wide): heads narrowly cylindrical, pale purple or whitish, 3–6 (7)-flowered: involucre bracts narrowly oblong, the inner acutish: corollas (5–) 5.5–7.5 mm. long, much exerted beyond the involucre: achenes 3–5 mm. long.—Open woods and wood borders in damp or rather dry rich light soil, but not in the coastal sands: eastern Massachusetts, southern New Hampshire, and southern Vermont, to Connecticut, and in the uplands to Georgia; westward through Ontario, New York, and Pennsylvania to Wisconsin, Nebraska and Oklahoma.

NEW HAMPSHIRE: Asquam Lake, 1914, *A. L. Gundersen*; Walpole, 1899, *M. L. Fernald*, no. 214. VERMONT: Pownal, 1898, *J. R. Churchill*, also *W. W. Eggleston*, no. 258; 1899, *Eggleston*, no. 1. MASSACHUSETTS: Revere, 1879 & 1882, *H. A. Young*; Middlesex Fells, 1894, *W. H. Manning*; Blue Hills, 1894, *C. G. French*; Readville, *C. E. Faxon*; Stockbridge, 1902, *R. Hoffmann*. CONNECTICUT: Waterbury, 1910, *A. E. Blewitt*, no. 1135; Hammond's Woods, Waterford, 1902, *C. B. Graves*, no. 302; New Haven, *D. C. Eaton*. NEW YORK: Oneida Lake, *old Torrey & Gray specimen*; various places in the Cayuga Lake Basin, 1919, *Eames, Randolph & Wiegand*, nos. 12983, 12984, 12985, 12986, also *Eames & Wiegand*, nos. 12982, 12989, and *A. J. Eames*, no. 12987; Junius, 1915, *Eames & MacDaniels*, no. 5090. VIRGINIA: Stony Man Mountain near Luray, 1901, *E. S. & Mrs. Steele*, no. 9; Bedford County, 1871 & 1872, *A. H. Curtiss*. WEST VIRGINIA: Parsons, 1904, *A. H. Moore*, no. 1994; East Fork of the Greenbrier River, Pocohontas County, 1904, *A. H. Moore*, no. 2380, and *J. M. Greenman*, no. 235; Gap Mountain, 1903, *E. S. & Mrs. Steele*, no. 186. KENTUCKY: on Big Black Mountain, Harlan County, 1893, *T. H. Kearney, Jr.*, no. 166. NORTH CAROLINA: Swain County, 1891, *Beardslee & Kofoid*. GEORGIA: north Georgia, 1875, *C. Wright*; Whitfield County, 1900, *P. Wilson*, no. 70; west of Cuthbert, 1903, *R. M. Harper*, no. 1877. ONTARIO: Queenston, 1911, *J. White*, no. 2. MICHIGAN: near Port Huron, 1892, *C. K. Dodge*; Flint, 1909, *E. E. Sherff*. INDIANA: Wabash River east of Bluffton, 1908, *C. C. Deam*, no. 5194. WISCONSIN: Brown County, 1901, *J. H. Schuette* (albino form); Kankauna, 1890, *Schuette*. ILLINOIS: Bloomington, 1886, *B. L. Robinson*; near Princeville, 1900, *V. H. Chase*, no. 716; Peoria, 1904, *F. E. MacDonald*; Havana, 1903, *H. A. Gleason*; St. Clair County, 1886, *H. Eggert*; Grand Tower, 1902, *H. A. Gleason*; Belknap, 1902, *Gleason*. IOWA: Ames, 1897, *Ball & Pammel*; Dakota City, 1896, *Pammel*, no. 33. NEBRASKA: Nemaha, 1910, *J. M. Bates*, no. 5211. OKLAHOMA: Grand River, Cherokee Nation, 1895, *J. W. Blankinship*; near Ottawa, 1913, *G. W. Stevens*, no. 2371.

*E. falcatum* is much more variable than *E. purpureum*. In the southern mountains it is often very slender (*E. amoenum* Pursh) but ordinarily it is large and frequently very tall with an expanded inflorescence as noted in the description. The nodes occasionally lose the purple coloration. The leaves vary widely in shape, and the pubescence is extremely variable in density, but it is always of the same loose type. The heads are usually pale, but may vary to white or to deeper purple. The transitions in all cases are so gradual, and the combinations so complex, that no subdivision of the species has seemed practical. The variation in florets was as follows: 4

with 3 florets, 7 with 4 florets, 25 with 5 florets, 24 with 6 florets, and 2 with 7 florets. The variation in number of leaves in a whorl was: 2 with 2 leaves (poor specimens), 20 with 3 leaves, 36 with 4 leaves, and 2 with 5 leaves.

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### THE AMERICAN AMMOPHILA.

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THE common Sand Reed, Psamma, Marram or Beach Grass, which covers the coastal sand dunes from the Straits of Belle Isle to North Carolina and occurs on sandy shores of the St. Lawrence system inland quite to Lake Superior, has been universally identified with *Ammophila arenaria* (L.) Link, the species occurring on the western and southern coasts of Europe. Superficially the two are very similar, although it needs only a glance at good material of typical *A. arenaria*, which occurs from southern Scandinavia to Portugal and Morocco, to see that the spike-like panicle is much shorter than in most of the American plant, *A. arenaria* having panicles only 0.5–2 dm. long, the panicles of the Atlantic American plant ranging from 1.5–4 dm. in length. In its long panicle the American plant is more nearly approached by the Mediterranean *A. arenaria*, var. *arundinacea* (Host) Husnot, in which the panicles may be 3 dm. long.

In all its technical characters, however, the long-panicled Mediterranean *Ammophila arenaria*, var. *arundinacea* agrees with the more northwestern typical European *A. arenaria*; but in these characters the European and Atlantic American plants are quite distinct, the Old World species being known in America only on the Pacific coast, where it has very recently been introduced as a sand binder. Briefly stated, the two species differ as follows: In *A. arenaria* the upper surface of the leaf-blade is copiously puberulent along the cartilaginous nerves, in the American merely serrulate-scabrous; in *A. arenaria* the ligule is scarious, lance-attenuate and very prolonged, commonly 1.5–3 cm. long, and lacerate at tip; in the Atlantic American plant, on the other hand, the ligule is chartaceous or coriaceous, rounded and very short, ranging from 1–3 mm. in length. In *A. arenaria*,